SPECIFICATION

Model No.: UMS-3002JD-G

☐ CUSTOMER : _____

APPROVED BY: _____ DATE: _____

※Please Sign and return one copy

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1. Basic Specifications

1-1 Mechanical specifications:

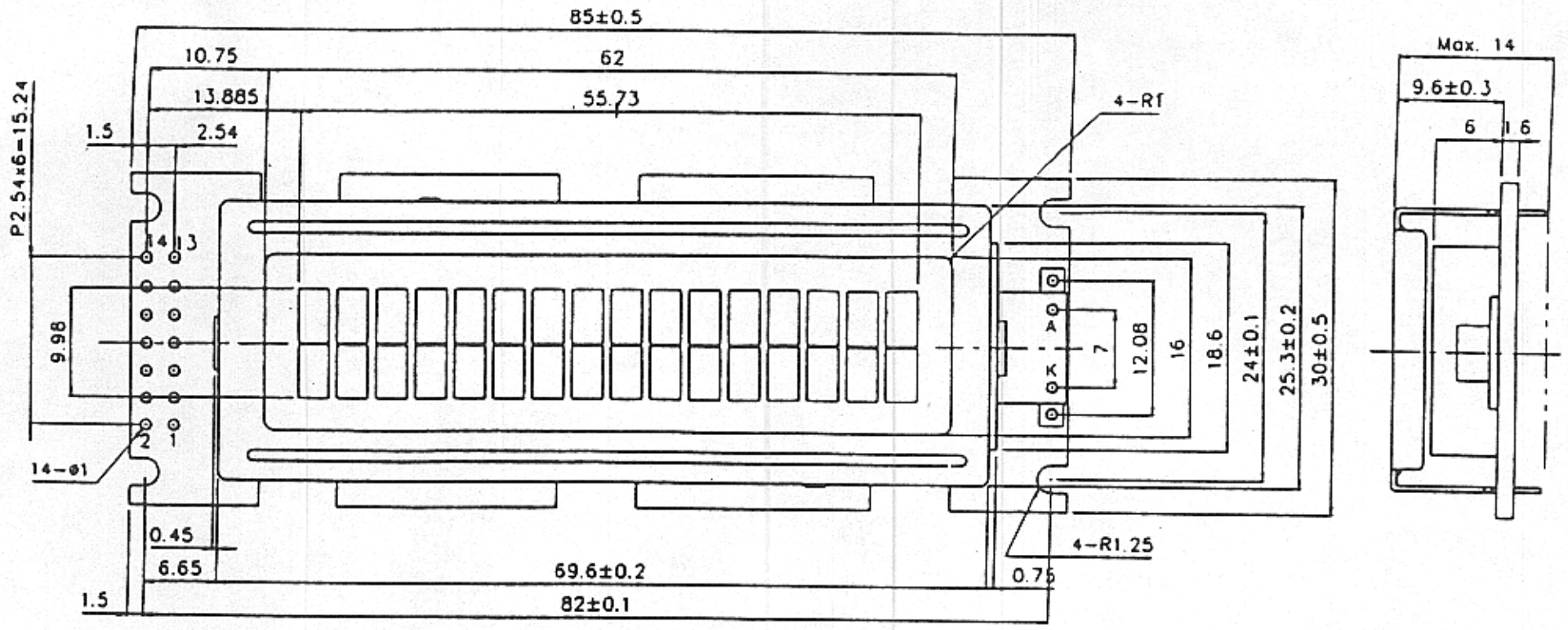
Items	Nominal Dimension	Unit
Character×Line	16×2	–
Module Size (W×H×T)	85.0×30.0×14.0	mm.
Viewing Area (W×H)	62.0×16.0	mm.
Active Area (W×H)	55.73×9.98	mm.
Character Font (W×H)	5×7 dots with cursor	–
Character Size (W×H)	2.78×4.89	mm.
Character Pitch (W×H)	3.53×5.09	mm.
Dot Size (W×H)	0.50×0.55	mm.
Dot Pitch(W×H)	0.57×0.62	mm
Driving Method	1/16	Duty
Driving IC Assembly	COB	–
Weight	30	g

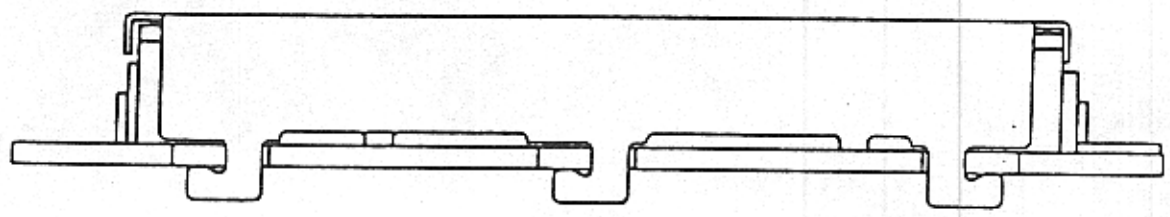
1-2 Display Specifications:

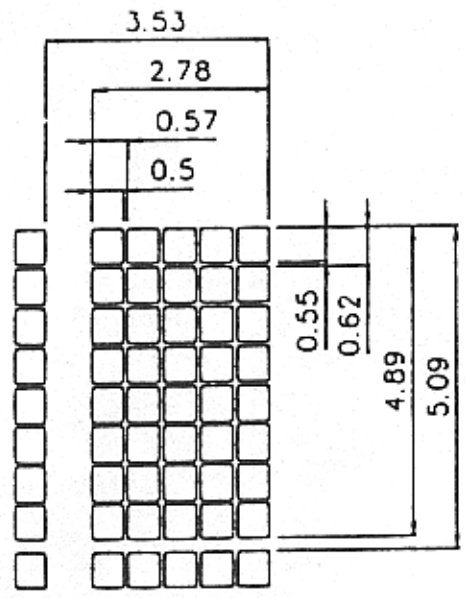
Display	Descriptions	Note
LCD Type	STN	
LCD Mode	Transflective	
Polarizer Mode	Positive	
Polarizer UV - Cutting	With	
Polarizer Surface	Normal	
Background Color	Gray	
Backlight Type	LED	
Viewing Angle	6 O'clock Direction	

＊Color tone is slightly changed by temperature and driving voltage.

1-3 Outline Dimension



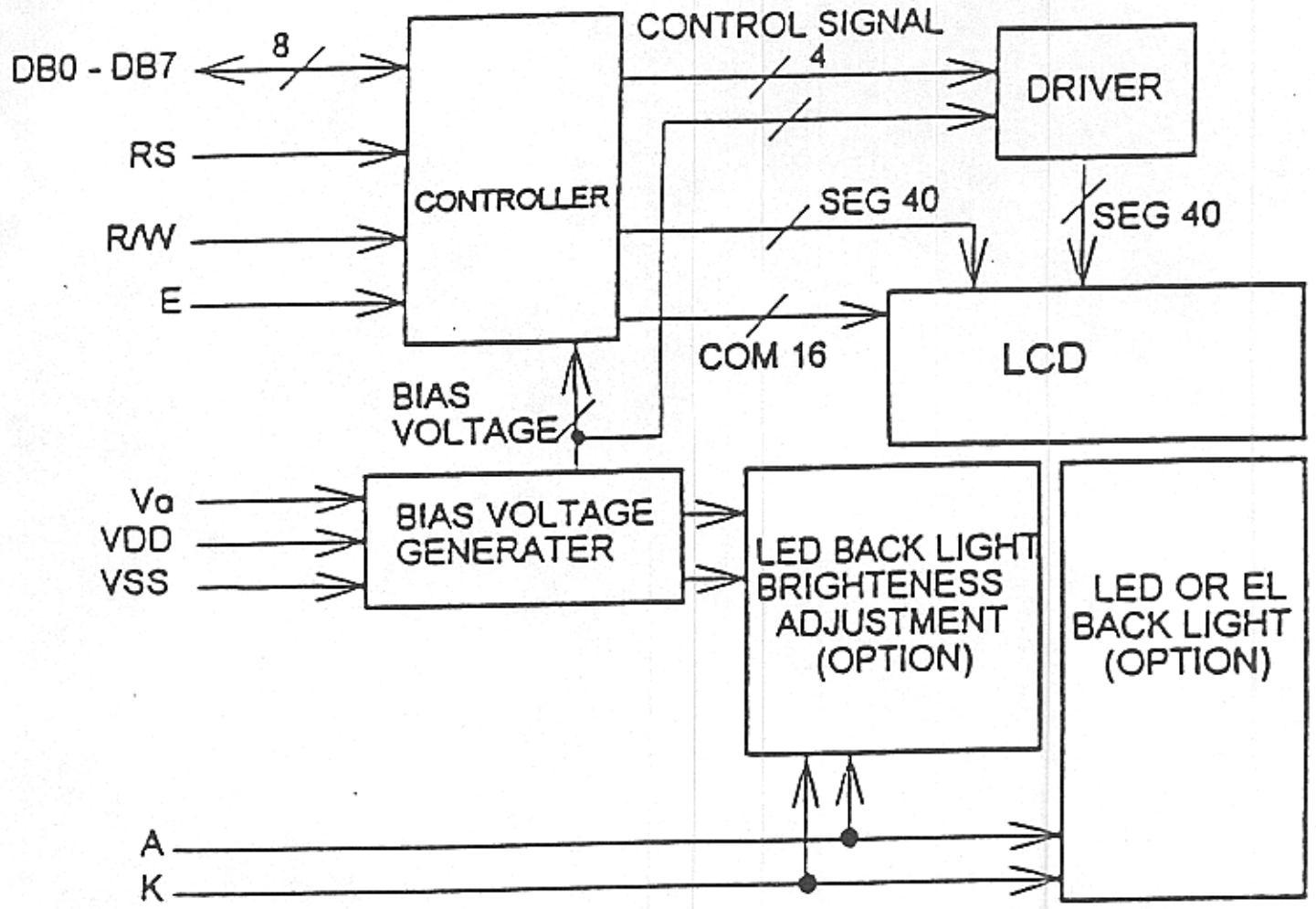




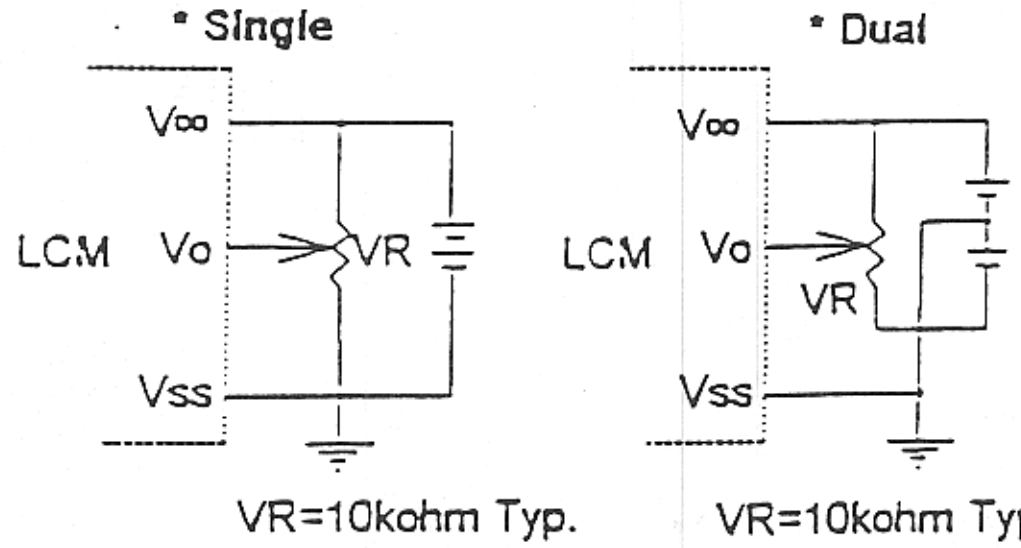
DISPLAY PATTERN

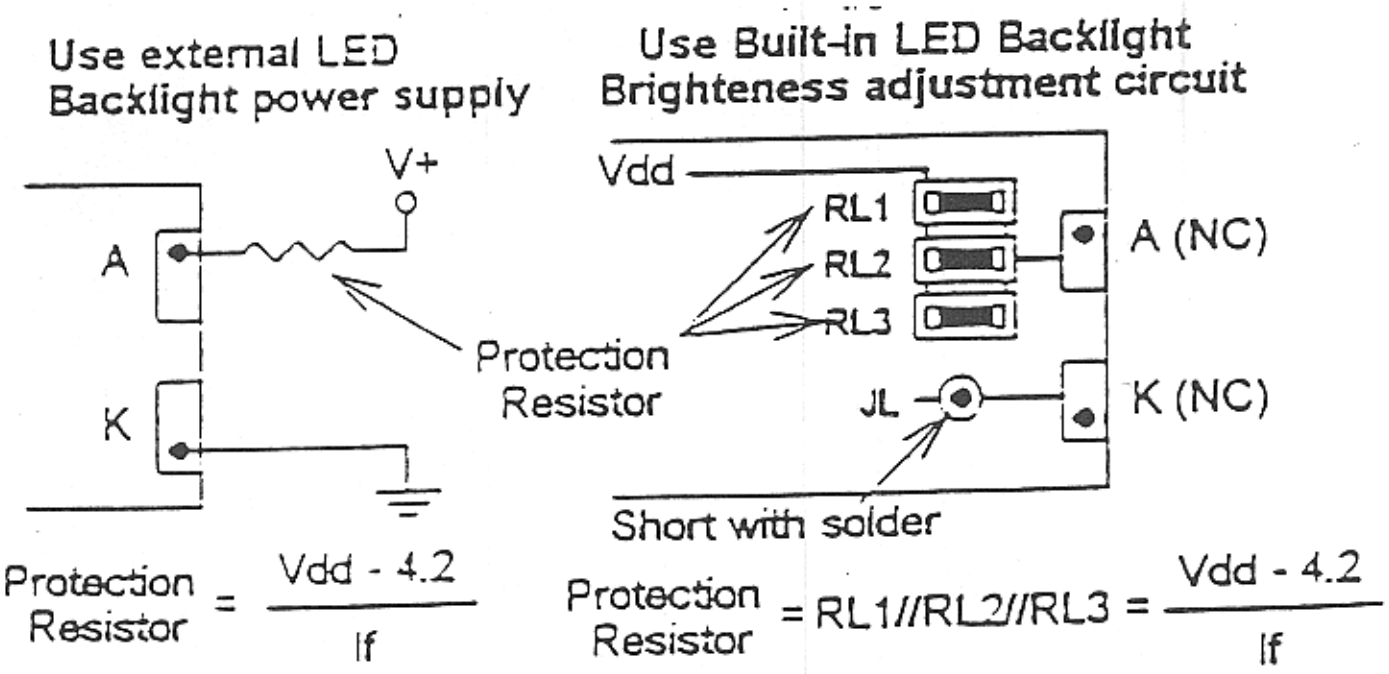
單位: m m

1-4 Block Diagram



1-5 Example of Power Supply





$$\text{Protection Resistor} = \frac{Vdd - 4.2}{If}$$

$$\text{Protection Resistor} = RL1//RL2//RL3 = \frac{Vdd - 4.2}{If}$$

* If : LED Backlight Forward Current

1-6 Interface Pin Connection:

☐ Pin Table

Pin No.	Pin Symbol	Input/Ouput	Name	Description
1	V_{SS}		Power Supply	0V(GND)
2	V_{DD}		Power Supply	For logical circuit (+5V±10%)
3	V_O		Power Supply	Contrast adjustment voltage
4	RS	Input	Register select	Register selection input High:data register(when reading and writing) Low:instruction register(when writing) Busy flag and address counter (when reading)
5	R/$\overline{W}$	Input	Read/Write	R/W: signal is used to select the read/write mode High:reading Low:writing
6	E	Input	Enable	Start enable signal to read or write the data
7-14	DB0-DB7	Input/Ouput	Data Interface	Used for data transfer between the MPU and the controller. These terminals are for data bus with bidirectional three-state.Initial 4 bit(DB0-DB3) are not used during 4 bit operation(DB7 can be used as a busy flag)
A	A(LED)	Input	Power Supply	Anode of LED Backlight(4.2V)
K	K(LED)	Input	Power Supply	Cathode of LED Backlight(0V)

2. Electrical Characteristics

2.1 Absolute Maximum Ratings

(V_{SS} = 0V, at 25℃)

Items	Symbol	Min.	Max.	Unit
Supply voltage for logics	V_{DD}-V_{SS}	-0.3	7.0	V
Supply voltage for driving LCD	V_{DD}-V_0	-0.3	V_{DD}+0.3	V
Input voltage	V_{IN}	-0.3	V_{DD}+0.3	V
Operating temperature range	T_{OP}	0	50	℃
Storage temperature range	T_{ST}	-10	60	℃

2.2 DC Characteristics

(V_{DD} = 5V ± 10%, V_{SS} = 0V, at 25℃)

Items	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply voltage (Logic)	V_{DD}-V_{SS}	4.5	5.0	5.5	V	
Supply voltage (LCD)	V_{DD}-V_0	3.9	4.3	4.6	V	*NOTE1
Input high level voltage	V_{IH}	2.2	— —	V_{DD}	V	
Input low level voltage	V_{IL}	-0.3	— —	0.6	V	
Output high level voltage	V_{OH}	2.4	— —	— —	V	I_{OH}=-0.205mA
Output low level voltage	V_{OL}	— —	— —	0.4	V	I_{OL}=1.2mA
Power supply current	I_{DD}	— —	1.55	2.5	mA	f_{osc}=270kHz ＊NOTE2

＊The above spec. may be changed by Rev. No.

*NOTE1 : Min. and Max. Voltage is specified as the voltage within the condition of operational temperature range 0℃ ~ 50℃.

Typ. Voltage is specified as module driving condition: T_a=25℃, V_{OP} at Optimum Contrast.

*NOTE2 :

Measureing Condition:

Standard Value MAX.

T_a = 25℃

V_{DD} - V_{SS} = 5.0V

V_{DD} - V_0 = V_{OP} at optimum Contrast

f_{osc} = 270kHz

Duty = 1/16 Duty

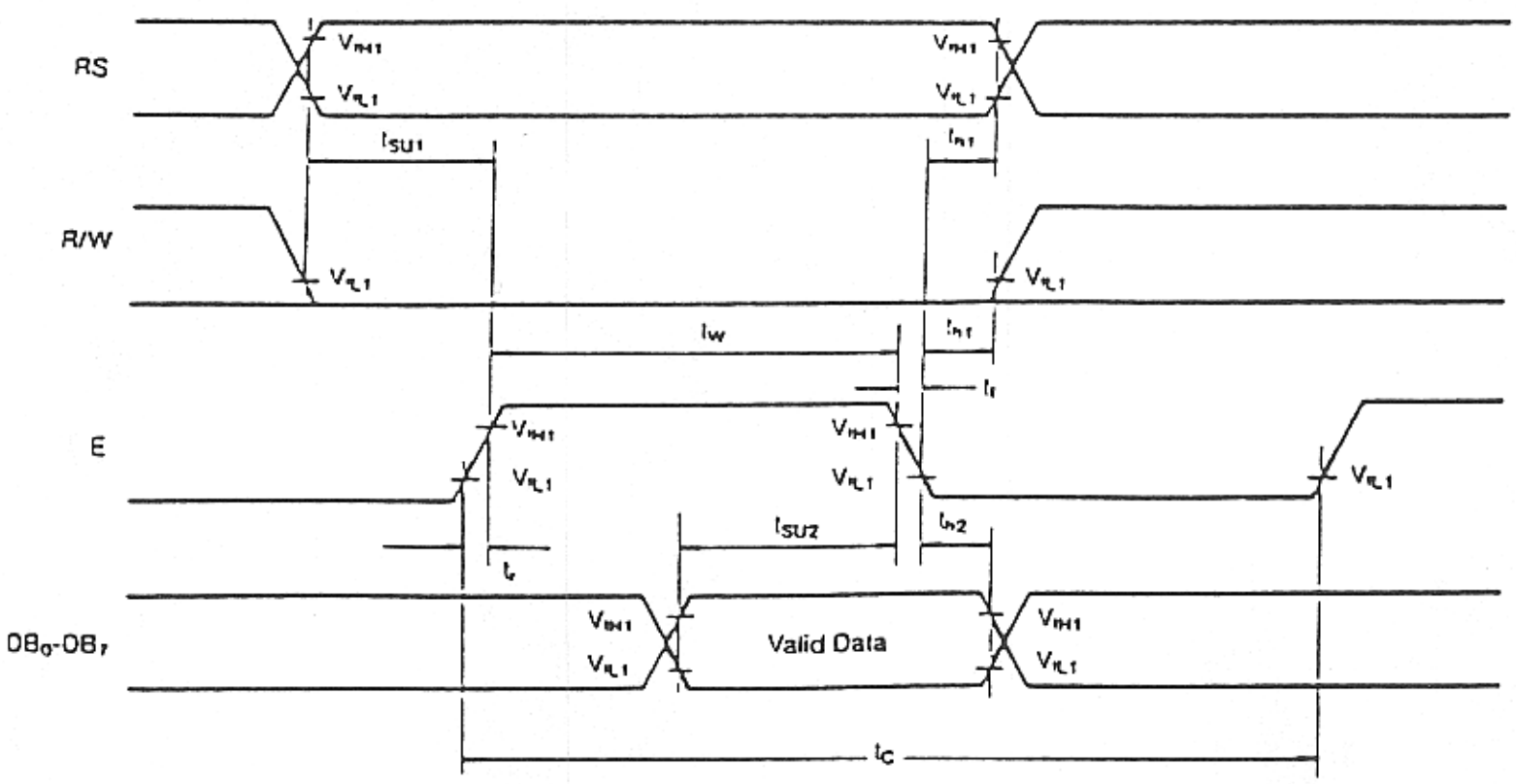
Display Pattern = Checkered pattern

2.3 AC Characteristics

(1)Write Mode(Writing data from micro-computer to Controller)

Items	Symbol	Min.	Typ.	Max.	Test Pin	Uint
E cycle time	tc	500	-	-	E	ns
E rise time	t_r	-	-	25	E	ns
E fall time	t_f	-	-	25	E	ns
E pulse width(High,Low)	t_w	220	-	-	E	ns
R/W and RS set-up time	t_{su1}	40	-	-	R/W,RS	ns
R/W and RS hold time	t_{h1}	10	-	-	R/W,RS	ns
Data set-up time	t_{su2}	60	-	-	$DB_0 \sim DB_7$	ns
Data hold time	t_{h2}	10	-	-	$DB_0 \sim DB_7$	ns

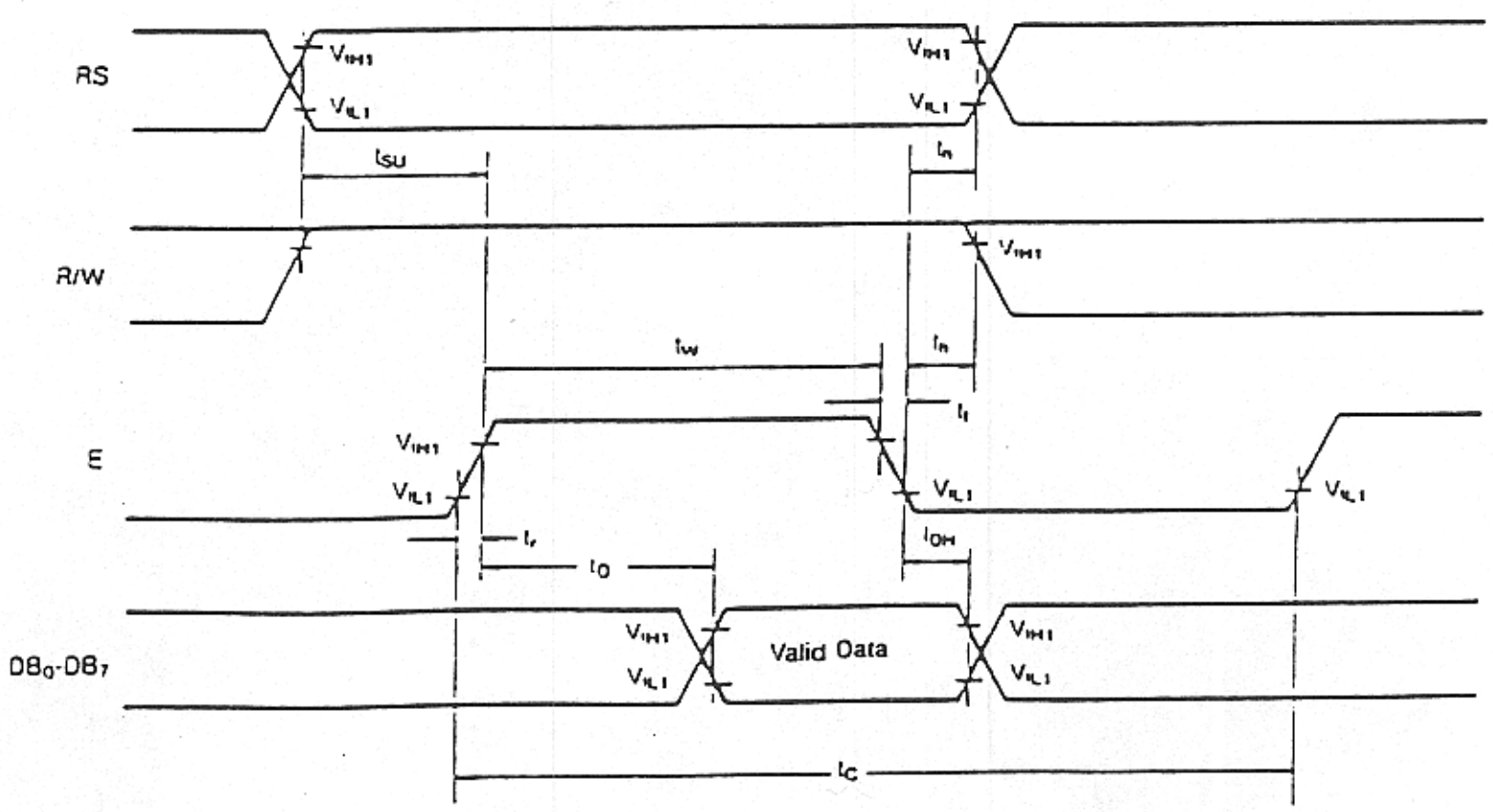
□Timing Characteristics



(2)Read Mode(Reading data from Controller to Micro-computer)

Items	Symbol	Min.	Typ.	Max.	Test Pin	Uint
E cycle time	tc	500	-	-	E	ns
E rise time	t_r	-	-	25	E	ns
E fall time	t_f	-	-	25	E	ns
E pulse width(High,Low)	t_w	220	-	-	E	ns
R/W and RS set-up time	t_{su}	40	-	-	R/W,RS	ns
R/W and RS hold time	t_h	10	-	-	R/W,RS	ns
Data set-up time	t_D	60	-	120	$DB_0 \sim DB_7$	ns
Data hold time	t_{DH}	20	-	-	$DB_0 \sim DB_7$	ns

□Timing Characteristics



3. Optical Characteristics

3.1 Optical Characteristics

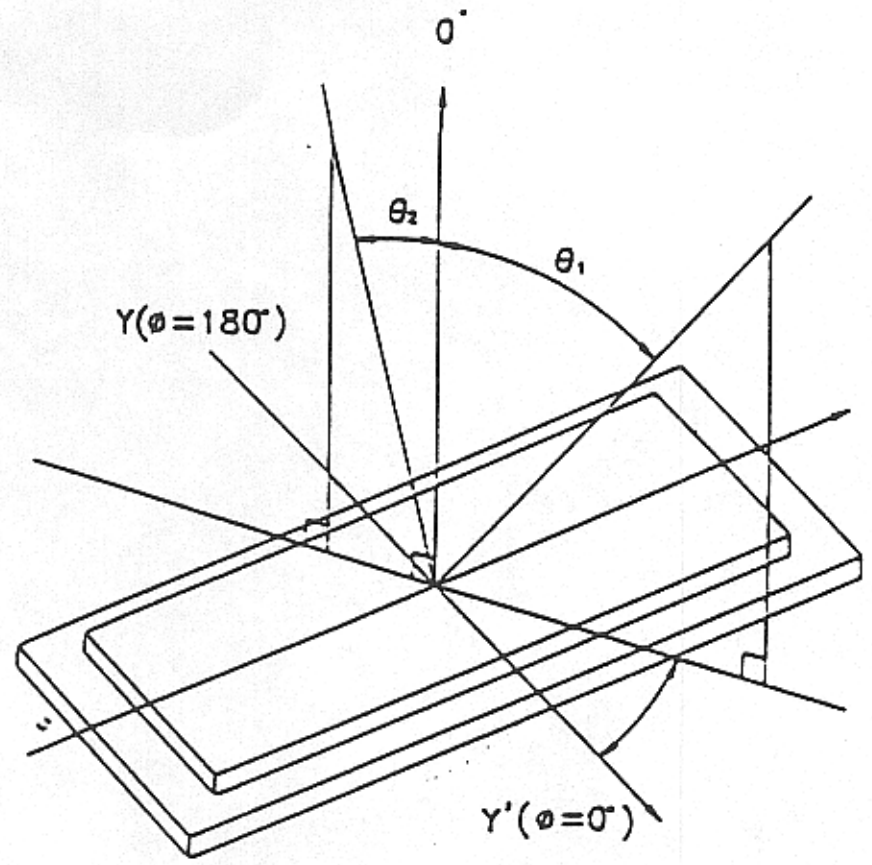
☐ **STN**

(V_{DD}=5V±5%)

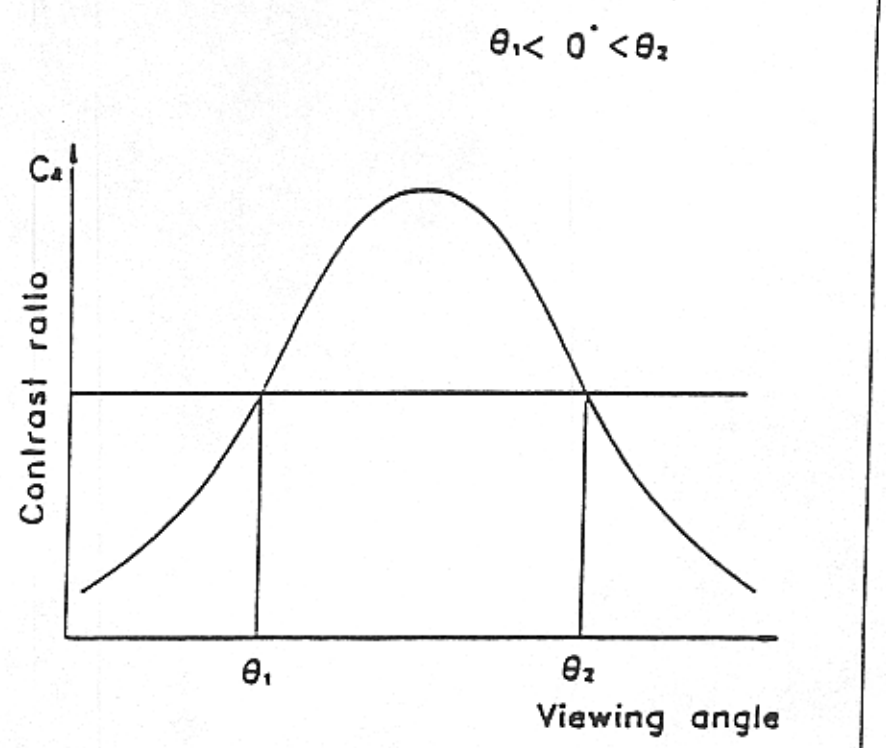
Items	Symbol	Condition	Min.	Typ.	Max.	Unit.
Response time	Rise time(t_r)	0℃	–	–	–	ms
		25℃	–	135	270	ms
	Fall time(t_d)	0℃	–	–	–	ms
		25℃	–	370	740	ms
Viewing Angle(θ) **Ta=25℃**	Front-rear	ϕ=0°	40	–	–	degree
		ϕ=180°	0	–	–	degree
	Right-left	ϕ=90°	30	–	–	degree
		ϕ=270°	30	–	–	degree
Contrast ratio **Ta=25℃**	C_R	θ=25° ϕ=0°	2	–	–	

3.2 Definition of Optical Characteristics

Note 1) Definition of viewing direction θ and ø

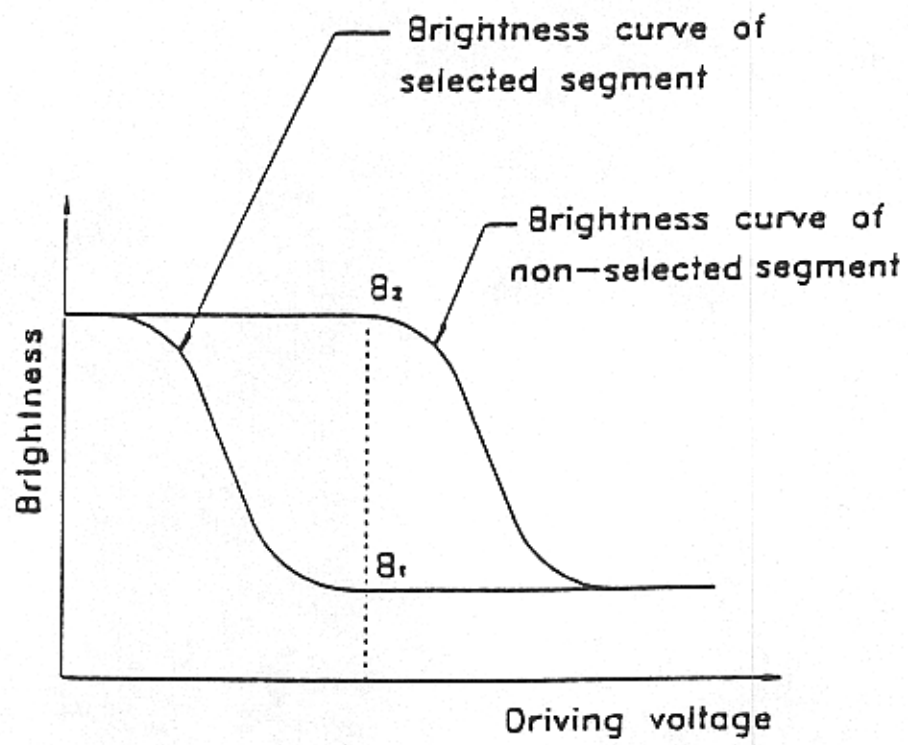


NOte 2) Definition of viewing angle θ_1 and θ_2

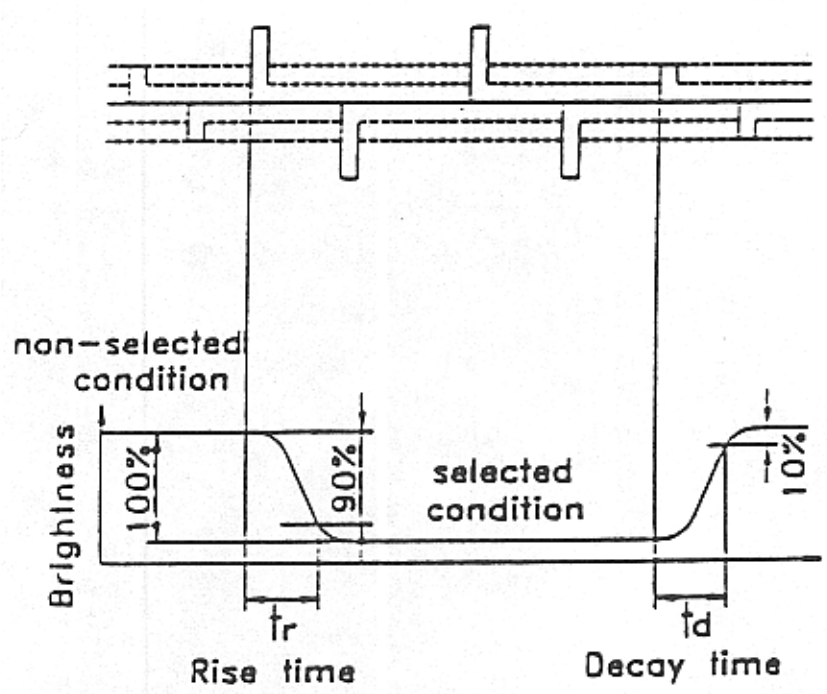


Note 3) Definition of contrast ratio C_R

$$C_R = \frac{\text{Brightness in non-selected segment}(B_2)}{\text{Brightness in selected segment}(B_1)}$$



Note 4) definition of optical response time



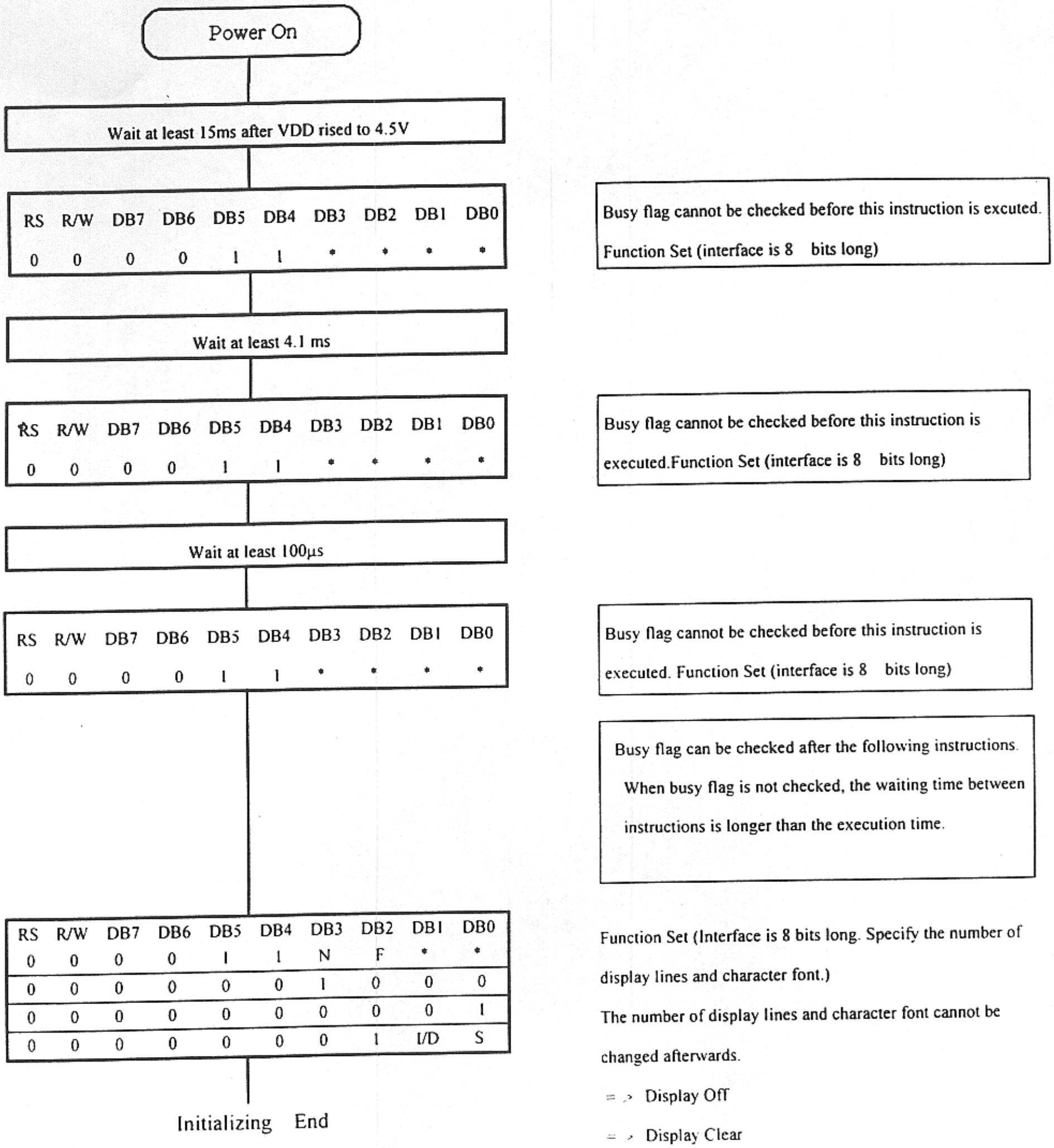
4. Control and Display Command

4.1 Instruction Table

Instruction	Code										Description	Execution time (at fosc=250kHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear display	0	0	0	0	0	0	0	0	0	1	Clears entire display and sets DD - RAM address 0 in address counter	1.64ms
Cursor home	0	0	0	0	0	0	0	0	1	*	cursor move to the first digit	1.64ms
Entry mode set	0	0	0	0	0	0	0	1	I/D	SH	I/D: set cursor move direction H: increse L: decrese SH: Specifies shift of display H: display is shifted L: display is not shifted	40 μs
Display ON/OFF control	0	0	0	0	0	0	1	D	C	B	#Display H: display ON , L: display OFF #Cursor H: cursor ON, L: cursor OFF #Blinking H: blinking ON. L: blinking OFF	40 μs
Cursor/Display shift----	0	0	0	.0	0	1	S/C	R/L	.*	.*	S/C H: display shift L: cursor move R/L H: right shift L: left shift	40 μs
Function set	0	0	0	0	1	DL	N	F	.*	*.	DL-H: 8 bits interface -L: 4 bits interface N- H: 2 line display -L: 1 line display F- H: 5× 10 dots -L: 5× 7 dots	40 μs
Set CGRAM address	0	0	0	1	CG RAM address (corresponds to cursor address)						CG RAM data is sent and received after this setting.	40 μs
Set DDRAM address	0	0	1	DDRAM address							DD RAM data is sent and received after this setting.	40 μs
Read busy flag/address	0	1	BF	Address counter used for both DD&CG RAM address							BF H: internally operating L: can accept instruction Reads BF indicating internal operation is being performed. and reads address counter contents.	0μs
Write data to CG or DD RAM	1	0	Write data								Writes data to DD RAM or CG RAM	46 μs
Read data to CG or DD RAM	1	1	Read data								Reads data to DD RAM or CG RAM	46 μs
	*:No Effect										DD RAM: Display data RAM CG RAM: Character generator RAM	Execution time changes with internal oscillation frequency (fosc) (Example) When fosc=270kHz 40μs× (250/270)=37μs

4.2 Initializing By Instruction

☐ **Initializing By Instruction (when interface is 8 bits long)**


Power On
Wait at least 15ms after VDD rised to 4.5V
RS R/W DB7 DB6 DB5 DB4 DB3 DB2 DB1 DB0
0 0 0 0 1 1 * * * *
Busy flag cannot be checked before this instruction is excuted.
Function Set (interface is 8 bits long)
Wait at least 4.1 ms
RS R/W DB7 DB6 DB5 DB4 DB3 DB2 DB1 DB0
0 0 0 0 1 1 * * * *
Busy flag cannot be checked before this instruction is executed.Function Set (interface is 8 bits long)
Wait at least 100μs
RS R/W DB7 DB6 DB5 DB4 DB3 DB2 DB1 DB0
0 0 0 0 1 1 * * * *
Busy flag cannot be checked before this instruction is executed. Function Set (interface is 8 bits long)
Busy flag can be checked after the following instructions.
When busy flag is not checked, the waiting time between instructions is longer than the execution time.
RS R/W DB7 DB6 DB5 DB4 DB3 DB2 DB1 DB0
0 0 0 0 1 1 N F * *
0 0 0 0 0 0 1 0 0 0
0 0 0 0 0 0 0 0 1
0 0 0 0 0 0 0 1 I/D S
Function Set (Interface is 8 bits long. Specify the number of display lines and character font.)
The number of display lines and character font cannot be changed afterwards.
=> Display Off
=> Display Clear
=> Entry Mode Set
Initializing End

☐ Initializing By Instruction (when interface is 4bits long)

Power On

Wait at least 15ms after VDD rised to 4.5V

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	1

Busy flag cannot be checked before this instruction is excuted.

Function Set (interface is 8 bits long)

Wait at least 4.1 ms

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	1

Busy flag cannot be checked before this instruction is executed.

Function Set (interface is 8 bits long)

Wait at least 100μs

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	1

Busy flag cannot be checked before this instruction is executed.

Function Set (interface is 8 bits long)

Busy flag can be checked after the following instructions.

When busy flag is not checked, the waiting time between instructions is longer than the execution time.

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	0
0	0	0	0	1	0
0	0	N	F	*	*
0	0	0	0	0	0
0	0	1	0	0	0
0	0	0	0	0	0
0	0	0	0	0	1
0	0	0	0	0	0
0	0	0	1	I/D	S

Function Set (Interface is 4 bits long. Specify the number of display lines and character font.)

The number of display lines and character font cannot be changed afterwards.

=> Display Off

=> Display Clear

=> Entry Mode Set

Initializing End

4.3 Standard Character Pattern

Upper 4bit / lower 4bit	LLLL	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
LLLL	CG RAM (1)														
LLLH	(2)														
LLHL	(3)														
LLHH	(4)														
LHLL	(5)														
LHLH	(6)														
LHHL	(7)														
LHHH	8)														
HLLL	(1)														
HLLH	(2)														
HLHL	(3)														
HLHH	(4)														
HHLL	(5)														
HHLH	(6)														
HHHL	(7)														
HHHH	(8)														

5. LED Backlight

5.1 General Description

LED backlight is a kind of solid state, active light source. It is incorporated with LCD as a backlight source.

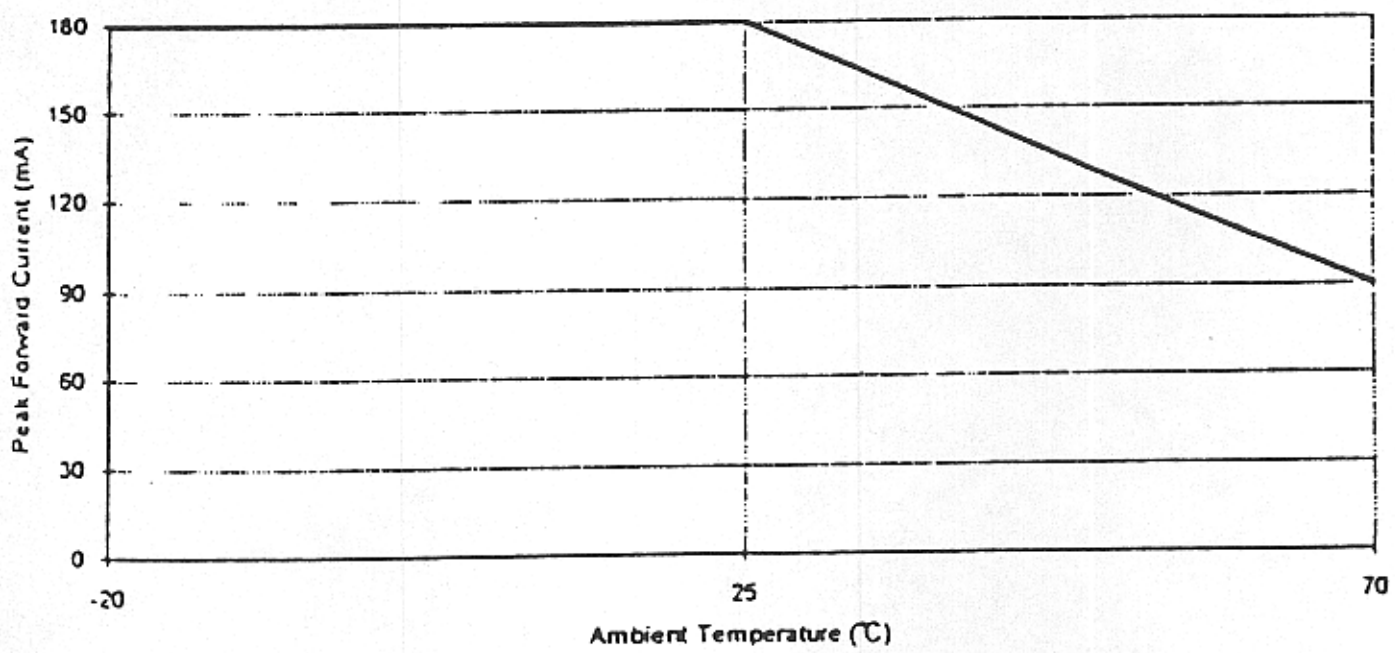
5.2 General Features

1 High reliablity and long life (Min. 50,000 Hr).
2 Bright and uniform luminance.
3 Low voltage driving (DC), inverter is unnecessary.
4 A variety of emitted color from red (700 nm) to pure green (555nm).
5 No influenced by interference.
6 Excellent mechanical strength.

5.3 Absolute Maximum Rating

Item	Symbol	Condition	Rating
Peak Forward Current (* 1)	If	Ta=25°C	180 mA
Reverse Voltage	V_R	Ta=25°C	8 V
Power Dissipation	Po	Ta=25°C	0.79 W
Operating Temperature	Topr	————	-20 ~ 70 °C
Storage Temperature	Tsto	————	-30 ~ 80 °C

*1 : Peak Forward Current vs. Ambient Temperature



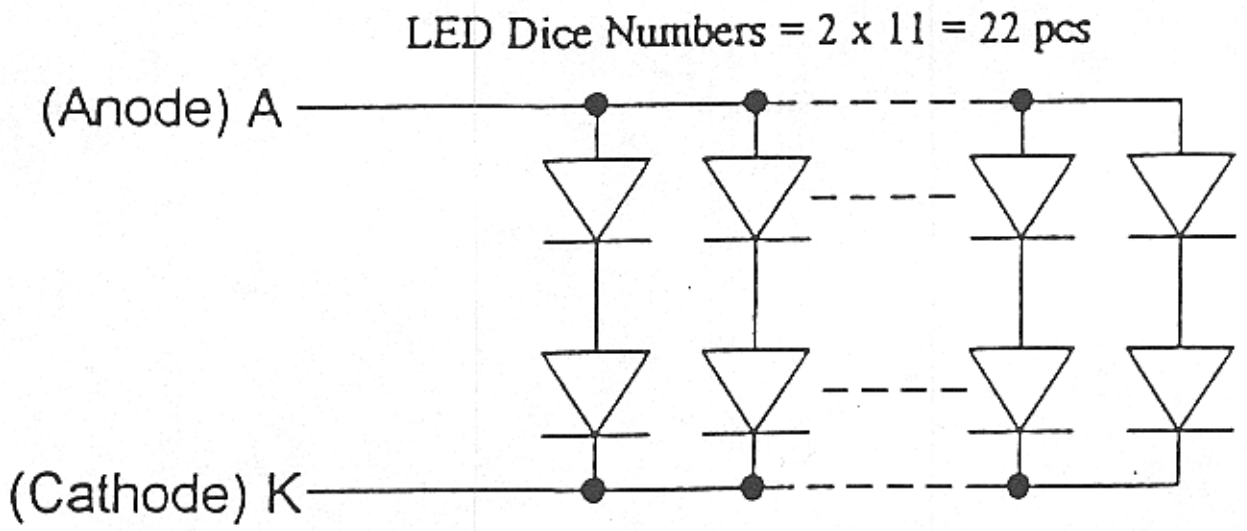
5.4 Optoelectronic Characteristics

Item	Symbol	Condition	Rating		
			Min.	Typ.	Max.
Forward Voltage	Vf	I_F=90 mA, Ta=25°C	3.8 V	4.2 V	4.4 V
Peak Emission Wavelength	λ_P	I_F=20 mA	——	570 nm	——
Reverse Current	I_R	V_R=8 V (Green Dice)	——	——	1.1mA
Spectral Line Half Width	$\triangle\lambda$	I_F=20 mA	——	30 nm	——
Average Luminous Intensity	B_{ave}	I_F=90 mA, Ta=25°C	93 cd/m²	115 cd/m²	——
Luminous Tolerance (* 2)	$\triangle B$	I_F=90 mA, Ta=25°C	——	30 %	50 %
Life (* 3)		I_F=90 mA, Ta=25°C	50,000 Hr		

* 2 : Luminous tolerance = $(B_{max} - B_{min}) / B_{max} \times 100\%$

* 3 : The time until the decrease to half of the initial brightness.

5.5 Connection LED Backlight



6. Reliability

6.1 Environmental Test

Item No	Items	Content of Test	Test Condition	Applicable Standard
1	High temperature storage	Endurance test applying the high storage temperature for a long time.	60℃ 200 Hrs	
2	Low temperature storage	Endurance test applying the low storage temperature for a long time.	-20℃ 200Hrs	
3	High temperature operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time	40℃ 200Hrs (*1)	
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time.	0℃ 200Hrs (*1)	
5	High temperature / humidity storage	Endurance test applying the high temperature and high humidity storage for a long time.	40℃ 90% RH 200Hrs	
6	Temperature cycle	Endurance test applying the low and high temperature cycles. -20℃ ⟷ 60℃ (30min.) (30min.) 1 Cycle	10 Cycle.	
7	Vibration test	10 ⟶ 55 ⟶ 10 Hz, within 1 minute amplitude 1.5mm .	15 minutes for each direction(X,Y,Z)	
8	Drop test	Packed, 100CM free fall, (6 sides, 1corner, 3edges)		

***1) : Driving condition for operation test:**

Power supply voltage for logic system = +5V

Power supply voltage for LCD system = Getting Optimum Contrast at 25℃

7. HANDLING INSTRUCTION

☐ PRECAUTION IN USE OF LCD

- Do not contact or scratch the front surface and the contact pads of an LCD panel with hard materials such as metal or glass or with one's nail.
- To clean the surface,wipe it gently with soft cloth dampened alcohol.
- Do not attempt to wiped off the contact pads.
- Keep LCD panels away from direct sunlight,also avoid storing them in a high-temperature&high humidity environment for a long period.
- Do not drive LCD panels by DC voltage.
- Do not expose LCD panels to organic solvent.
- Liquid in LCD is hazardous substance, any contacts with liquid crystal materials ,wash it off immediately with soap and water.
- The polarizer is easily damaged and should be handle with special care.Do'nt press or rub it with hard objects.

☐ PRECAUTION FOR HANDLING LCM

- The LCD module contains a C-MOS LSI.To avoid damage to the LSI from static electricity generated while working,Ground your body,work/assembly areas and assembly equipment to protect the module against STATIC ELECTRICITY.
- Do not input any signal before power is turned on.
- Do not take LCM from it's packaging bag until it is assembled.
- Peel off the LCM protective film slowly since static electricity may be generated.
- Pay attention to the humidity of the work shop,50~60%RH is satisfactory.
- Use a non-leak iron for soldering LCM.
- Do not touch the display surface or connection terminals area with bare hands.Smudges on the display surface reduce the insulation between terminals.
- Cautions for soldering to LCM:
  Conditions for soldering I/O terminals:
  Temperature at iron tip: 280℃ ±10℃.
  Soldering time : 3~4 sec./ terminal.
  Type of solder : Eutectic solder(rosin flux filled).

☐ PRECAUTION FOR STORING LCM

- To avoid degradation of the device,do not store the module under the conditions of direct sunlight,high temperature or high humidity.Keep the module in bags designed to prevent static electricity charging under low temperature / normal humidity conditions(avoid high temperature / high humidity and low temperature below 0 ℃).